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User's Guide

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It is the policy of OMEGA to comply with all worldwide safety and EMC/EMI regulations that apply. OMEGA is constantly pursuing certification of its products to the European New Approach Directives. OMEGA will add the CE mark to every appropriate device upon certification.

The information contained in this document is believed to be correct, but OMEGA Engineering, Inc. accepts no liability for any errors it contains, and reserves the right to alter specifications without notice.

WARNING: These products are not designed for use in, and should not be used for, patient-connected applications.

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GENERAL INFORMATION

This manual will assist you in installing and maintaining your FTB380 Series turbine meter and associated display electronics. The turbine meters can be purchased with or without the display electronics. (See Figure 1)

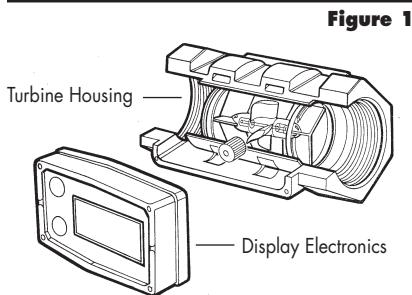


Figure 1

When purchased with the display electronics, optional accessory modules are available for field installation. Information on these accessories is contained in separate manuals. Calibration details using the display electronics are given in this manual.

When purchased without the display (Suffix - ND) an optional field installable Pulse Output Module (FLSC790-P-ND) is available and described in a separate manual.

For best results, take the time to fully acquaint yourself with all information about all components of your FTB380 Series Turbine Meter System prior to installation and use. If you need assistance, contact the Omega Flow Application Department.



This symbol is used throughout the manual to call your attention to safety messages.

WARNING

Warnings alert you to the potential for personal injury.

CAUTION

Cautions call your attention to practices or procedures which may damage your equipment.

Notes give information that can improve efficiency of operations.

It is your responsibility to make sure that all operators have access to adequate instructions about safe operating and maintenance procedures.

Read Me!

For your safety, review the major warnings and cautions below before operating your equipment.

WARNING

The apparatus enclosure may contain aluminum and is considered to constitute a potential risk of ignition by impact or friction. Care must be taken into account during installation and use to prevent impact or friction.

WARNING

Part of the enclosure is constructed from plastic. To prevent the risk of electrostatic sparking the plastic surface should only be cleaned with a damp cloth.

1. This equipment is approved to handle only fluids which are compatible with all wetted materials.
2. When measuring flammable liquids, observe precautions against fire or explosion.

3. When handling hazardous liquids, always follow the liquid manufacturer's safety precautions.
4. When working in hazardous environments, always exercise appropriate safety precautions.
5. Always dispose of used cleaning solvents in a safe manner according to the solvent manufacturer's instructions.
6. During turbine removal, liquid may spill. Follow the liquid manufacturer's safety precautions for clean up of minor spills.
7. Do not blow compressed air through the turbine.
8. Do not allow liquids to dry inside the turbine.
9. Handle the rotor carefully. Even small scratches or nicks can affect accuracy.
10. When tightening the turbine, use a wrench only on the wrench flats.
11. For best results, always verify accuracy before use.

PRODUCT DESCRIPTION

FTB380 Series Turbines are identified by the internal diameter of the inlet and outlet.

A109GMA100NA1 – 1/2 inch (Low Flow)
A109GMA100NA1 – 1 inch (Mid Flow)
A109GMA200NA2 – 2 inch (High Flow)

Each of these turbines are designed to work with on-board display electronics and/or with one of several accessory modules that can interface to a wide variety of reporting and collecting devices.

The CMOS microprocessor-based electronics have extremely low power requirements and data retention capabilities in both RAM and ROM. Information is clearly displayed on a large 6-digit LCD readout with two-point floating decimal for totals from .01 to 999,999. All operations are easily accessed with the two buttons on the front panel.

Liquids flow through the turbine housing causing an internal rotor to spin. As the rotor spins, an electrical signal is generated in the pickup coil. The electrical signal provides the output necessary to operate the on-board display electronics for local indication directly on the turbine or one of several accessory modules that transmit the signal to external equipment.

Upon receipt, examine your meter for visible damage. The turbine is a precision measuring instrument and should be handled as such. Remove the protective plugs and caps for a thorough inspection. If any items are damaged or missing, contact OMEGA Customer Service.

Make sure the turbine model meets your specific needs. Refer to the Specifications Section and confirm the following:

1. The flowrate is within the limits of your model.
2. The liquid is compatible with the turbine's wetted components.
3. The system's pressure does not exceed the turbine's maximum pressure rating.

Information specific to your particular turbine, including serial number and manufacturing date is printed on the bottom of the turbine.

SN = Serial Number, a 7-8 digit number that identifies this particular turbine.

MFD = Manufacturing Date indicating the week and year of manufacture.

For your future reference, it might be useful to record this information in the manual in case it becomes unreadable on the turbine.

INSTALLATION

All Series FTB380 turbines are designed to measure flow in only one direction. The direction is indicated by the arrow cast-molded in the turbine outlet. If the opposite direction is desired, and you are using on-board display electronics, rotate the display electronics 180 degrees prior to installation.

Flow altering devices such as elbows, valves, and reducers can affect accuracy. The following recommended guidelines are given to enhance accuracy and maximize performance. Distances given here are minimum requirements; double them for desired straight pipe lengths.

Upstream from the turbine, allow a minimum straight pipe length at least 10 times the internal diameter of the turbine. For example, with the A109GMA100NA1 turbine, there should be 10 inches (25.4 cm) of straight pipe immediately upstream. The desired upstream straight pipe length is 20 inches (50.8 cm).

Downstream from the turbine, allow a minimum straight pipe length at least 5 times the internal diameter of your turbine. For example, with the A109GMA100NA1 turbine, there should be 5 inches (12.7 cm) of straight pipe immediately downstream. The desired downstream distance is 10 inches (25.4 cm).

A typical back pressure of 5 to 50 PSI (0.34 to 3.4 bar) will prevent cavitation. Create back pressure by installing a control valve on the downstream side of the meter at the proper distance detailed above.

Foreign material in the liquid being measured can clog the turbine's rotor and adversely affect accuracy. If this problem is anticipated or experienced, install screens to filter impurities from incoming liquids.

Model A109GMA025NA1

Maximum Particulate Size

Inches:	0.005
Microns:	125
Mesh:	55
Standard Sieve:	125 μm
Alternative Sieve:	No. 120

Models A109GMA100NA1 and A109GMA200NA2

Maximum Particulate Size	
Inches:	0.018
Microns:	500
Mesh:	28
Standard Sieve:	500 μm
Alternative Sieve:	No. 35

All Series FTB380 turbines are Factory Mutual Approved and carry a Class 1, Division 1 Approval for hazardous environments. They are tested and calibrated at the factory using state-of-the-art calibration procedures and test equipment.

To ensure accurate measurement, remove all air from the system before use. To purge the system of air:

1. Ensure some back pressure on the turbine.
2. Open the discharge valve or nozzle and allow fluid to completely fill the system. Make sure the stream is full and steady.
3. Close the discharge valve or nozzle.
4. Start normal operations.

Each turbine contains a removable back coverplate. Leave the coverplate installed unless accessory modules specify removal.

CONNECTIONS

1. To protect against leakage, seal all threads with an appropriate sealing compound. Make sure the sealing compound does not intrude into the flow path.
2. Make sure the arrow on the outlet is pointed in the direction of the flow.
3. Tighten the turbine onto the fittings. Use a wrench only on wrench flats.

NOTE: If connecting to new male threads, burrs andcurls can adversely effect accuracy. Correct the problem prior to turbine installation.

It is strongly recommended that accuracy be verified prior to use. To do this, remove all air from the system, measure an exact known volume into an accurate container, and verify the volume against the readout or recording equipment. If necessary, use a correction factor to figure final volume. For best results, accuracy should be verified periodically as part of a routine maintenance schedule.

The display electronics is normally installed on the turbine housing at the factory unless ordered without it.

If for any reason the display electronics need to be mounted on your turbine, simply mount the display on the turbine with the four screws at the corners of the faceplate. Make sure the seal is fully seated before tightening the screws.

If you ordered the FTB380 Series turbine with an accessory module, please review and thoroughly understand all installation instructions before proceeding.

Avoid electronically “noisy” environments. Install at least 6 inches (15.2 cm) away from motors, relays, or transformers.

OPERATION

All operations are reflected in the LCD readout. The large center digits indicate amounts, where smaller words or “icons” located above and below indicate specific information regarding totals, flow, calibration and units of measure.

Activate the Meter

The computer is on continuously and always ready to perform. The computer is powered by field replaceable batteries. When display becomes dim, faded or the low battery message appears (see below), the batteries need to be replaced. Reference the Maintenance Section for details.

LobATT

Batch and Cumulative Totals

The computer maintains two totals. The Cumulative Total provides continuous measurement and cannot be manually reset. The Batch Total can be reset to measure flow during a single use. The Cumulative Total is labeled TOTAL 1, Batch Total is labeled TOTAL 2 BATCH.

When the Cumulative Total reaches a display reading of 999,999 the computer will highlight an X10 icon. This indicates to the operator that a zero must be added to the 6 digits shown. When the next rollover occurs, the computer will highlight an X100 icon. This indicates to the operator that two zeroes must be added to the 6 digits shown.

Press the DISPLAY button briefly to switch between the TOTAL 1, TOTAL 2 BATCH and FLOWRATE. Press DISPLAY briefly to display the TOTAL 2 BATCH. Hold the DISPLAY button for 3 seconds to reset the Batch Total to zero.

When fluid is flowing through the meter, a small propeller icon is highlighted.

Flowrate Feature

To use this feature, press and release DISPLAY button until FLOWRATE icon appears. The factory set time base will be highlighted to the right of FLOWRATE (M = Minutes, H = hours, D = days). When FLOWRATE is invoked, the display will be indicating rate of flow.

Factory and Field Calibration

All calibration information is visible to the user as icons on the top line of the display, above the numeric digits.

All units are configured with a “factory” calibration. Both gallons and litres are available (“GL” or “LT” will be displayed). While holding the CALIBRATE button, briefly press DISPLAY to toggle between gallons and litres. This factory calibration (indicated with FAC) is permanently programmed into the computer and is not user adjustable.

NOTE: Your computer may have other units of measure programmed into it. If so, holding the CALIBRATE button and momentarily pressing the DISPLAY button will toggle through all factory set units. Other possible units are: IGL (imperial gallon), QT (quart), CF (cubic feet), CM (cubic meter), BL (42 gal. barrel), CC (cubic centimeter) or OZ (ounce).

Switching between different units will not corrupt the Total’s contents. For example, in GL mode, the computer totalizes 10.00 gallons, if the user switches to LT mode, the display will read 37.85 litres (the same volume, different unit).

The “field” calibration may be set by the user, and can be changed or modified at any time using the calibration procedure described in the Calibration Section. Totals or flowrate derived from the field calibration are invoked when the FAC icon is no longer visible on the top line of the display.

CALIBRATION

Verify Accuracy Before Beginning Field Calibration

For the most accurate results, dispense at a flowrate which best simulates your actual operating conditions. Avoid “dribbling” more fluid or repeatedly starting and stopping the flow. This can result in less accurate calibrations.

Make sure you meet the meter’s minimum flowrate requirements:

A109GMA025NA1 meter	.3 GPM (1.1 LPM)
A109GMA100NA1 meter	3 GPM (11.0 LPM)
A109GMA200NA2 meter	30 GPM (113 LPM)

The use of a uniformly dependable, accurate calibration container is recommended for the most accurate results. Due to high flowrate, it is strongly recommended that calibration be completed with a combination of volume and weight using fine resolution scales. For best results, the meter should be installed and purged of air before field calibration.

Field Calibration with Computer Display

Field Calibration and Factory Calibration are defined in the Operation Section. Factory calibration settings are programmed into each computer during manufacturing, using standard test solvent at 70° F (21° C). Settings are correct for light liquids such as water, gasoline or diesel. Readings using the Factory Calibration (FAC) may not be accurate in some situations, for example, “heavy” liquids such as motor oil under extreme temperature conditions, non-standard plumbing configurations or with fluids other than water.

For improved accuracy under such conditions, the computer allows for “field” calibration, that is, user entry of custom calibration parameters. A “single point” calibration may yield acceptable accuracy when used in a non-standard application.

Field Calibration Procedures (Dispense/Display Method)

1. To field calibrate, press and hold the CALIBRATE and DISPLAY buttons for about 3 seconds until you see FLdCAL. Release both buttons and you will see dd000.0. You are now in the field calibration mode.
2. Dispense a known amount of fluid at a flowrate representative of the application. Any amount between 000.1 and 999.9 units can be used. Display will count up while fluid is flowing through the meter.
3. The DISPLAY button can then be pushed to select the digit location and the CALIBRATE button can be pushed to scroll the desired value at the blinking position. Edit the amount shown with the value that was dispensed above. Values from 000.1 to 999.9 can be entered.
4. When satisfied with the value, press both CALIBRATE and DISPLAY buttons simultaneously. CALEnd will be displayed and unit will go back to normal operation, less the FAC (factory calibration) icon.
5. The meter will now be operating with a custom calibration number unique to the above dispense procedure. No unit of measure (gallon, litre, etc.) icon will be highlighted

NOTE: To return to factory calibration (FAC), press and hold both CALIBRATION and DISPLAY buttons for about 3 seconds, until FAxCAL is displayed. Then release buttons. Unit should return to normal operation and FAC icon visible

NOTE: If the field calibration mode is entered and NO fluid is dispensed, then upon leaving, the computer will use data from the last successful field calibration.

MAINTENANCE

Verify Accuracy

Before use, check the turbine's accuracy and verify calibration.

1. Make sure there is no air in the system.
2. Measure an exact known volume into an accurate container.
3. Verify the volume against the readout or recording equipment.

For best results, accuracy should be verified periodically as part of a routine maintenance schedule.

Remove the Turbine

⚠ WARNING

During turbine removal, liquid may spill. Follow the liquid manufacturer's safety precautions for clean up of minor spills.

1. Ensure all liquid is drained from the turbine. Wear protective clothing as necessary.
2. Loosen both ends of the turbine. Use a wrench only on the turbine's wrench flats.
3. If the turbine is not immediately installed again, cap lines as necessary.

Clean the Turbine

During use, the turbine should be kept full of liquid to ensure that drying does not occur inside the turbine. If drying or caking should occur, the rotor will stick or drag, affecting accuracy. To determine if the rotor is stuck or dragging, gently blow air through the meter and listen for the quiet whir of the rotor.

⚠ CAUTION

Never blow compressed air through the meter. It could damage the rotor.

1. Remove the turbine from the system following the directions above.

⚠ WARNING

Follow the liquid manufacturer's instructions for the disposal of contaminated cleaning solvents.

2. When the rotor turns freely, assemble and install it again following the instructions above.

Display Electronics

The display electronics are powered by lithium batteries which provide at least four years of actual use. If the meter's readout should become dim, blank or the low battery message appears (see below), the batteries should be replaced. Replacement batteries can be ordered from the factory. See details in the Parts Section.

LobAtt

When batteries are disconnected or fail, values in Batch and Cumulative Totals will remain. Factory and Field Calibration Curves are retained in the meter's computer when power is lost.

It is strongly recommended that battery check and terminal cleaning be a part of a routine maintenance schedule. Battery terminals should be cleaned annually. Batteries can be replaced without removing the meter from the piping system.

Replacing the Batteries

1. Remove the corner screws from the meter face and lift the display electronics from the turbine.
2. Remove the batteries.
3. Check the battery terminals and remove any corrosion.
4. Install the new batteries and make sure the positive posts are positioned correctly. When the batteries are installed correctly, the computer powers on automatically and the readout displays information.
5. Make sure the seal is fully seated before placing the computer electronics on the turbine. Tighten the four screws.

TROUBLESHOOTING

Symptom	Probable Cause	Corrective Action
Meter is not accurate	<ol style="list-style-type: none"> 1. Field Calibration not performed properly 2. Factory Calibration not suitable for liquid being measured 3. Meter operated below minimum flowrate 4. Meter partially clogged with dried liquid 5. Turbine bearings partially clogged with dried liquid 6. Sealant material wrapped around rotor 7. Installed too close to fittings 8. Installed too close to motors or electrically “noisy” environment 9. Improper connections to recording device 10. Accuracy needs verification 	<p>Field calibrate again or select Factory Calibration.</p> <p>Perform a Field Calibration according to Calibration Section.</p> <p>Increase flowrate.</p> <p>Remove meter. Clean carefully. Make sure rotor spins freely.</p> <p>Remove meter. Clean carefully. Make sure rotor spins freely.</p> <p>Remove meter. Make sure rotor spins freely.</p> <p>Install correctly.</p> <p>Install correctly.</p> <p>Check all electrical connections. Reference appropriate installation instructions.</p> <p>Complete normal accuracy verification procedures. Repeat periodically.</p>
Readout faded or blank	<ol style="list-style-type: none"> 1. Batteries weak, dead, or not connected 2. Display electronics defective 	<p>Remove display electronics. Check and replace batteries if necessary.</p> <p>Contact the factory.</p>
Normal flowrate but meter does not count (Meter comes on when DISPLAY button pushed)	<ol style="list-style-type: none"> 1. Field Calibration not performed correctly 2. Rotor stuck or damaged 3. Sealant material wrapped around rotor 4. Display electronics defective 	<p>Field Calibrate again or select Factory Calibration.</p> <p>Remove meter. Make sure rotor spins freely.</p> <p>Remove meter. Make sure rotor spins freely.</p> <p>Contact the factory.</p>
Reduced flowrate and meter does not count (Meter comes on when DISPLAY button pushed)	<ol style="list-style-type: none"> 1. Meter clogged with dried liquids 2. Below minimum flowrate 	<p>Remove meter. Clean carefully. Make sure rotor spins freely.</p> <p>Increase flow.</p>

SPECIFICATIONS - TURBINE

All data for A109GMA025NA1 and A109GMA100NA1 determined with 1 centipoise Kermac solvent test fluid at 70° F (21° C). Data for FTB385 is determined with water at 70° F (21° C).

Models Size	A109GMA025NA1 1 inch Low Flow	A109GMA100NA1 1 inch	A109GMA200NA1 2 inch
Linear Flow Range Gallons/minute (GPM) Litres/minute (LPM)	0.3-3 1-11	3-50 11-190	30-300 114-1,135
Maximum Flow Gallons/minute (GPM) Litres/minute (LPM)	3 11	50 190	300 1,135
Maximum Pressure Drop in 10:1 Range PSIG bar	8 0.55	5 0.34	4 0.28
Frequency Range in Flow Range	11-110 Hz @ 0.3-3 GPM	36.5-608.3 Hz @ 3-50 GPM	36-360 Hz @ 30-300 GPM
Connections NPT Female Inlet/Outlet Size	Yes Yes 1 in.	Yes Yes 1 in.	Yes Yes 2 in.
Weight with Computer Electronics Pounds Kilograms	1.35 lbs. .61 kg	1.35 lbs. .61 kg	3.0 lbs. 1.36 kg

Performance

Linear Range for 1 in. Low Flow:	N/A*
Linear Range for 1 in.:	± 1.5% of reading
Linear Range for 2 in.:	± 1.5% of reading
Repeatability for 1 in. Low Flow:	± 1%
Repeatability for 1 in.:	± 0.2%
Repeatability for 2 in.:	± 0.2%

Pressure Rating

300 PSIG (21 bar)

Wetted Components

Housing:	Aluminum
Journal Bearings:	Ceramic (96% Alumina)
Shaft:	Tungsten Carbide
Rotor and Supports:	Nylon
Retaining Rings:	316 Stainless Steel

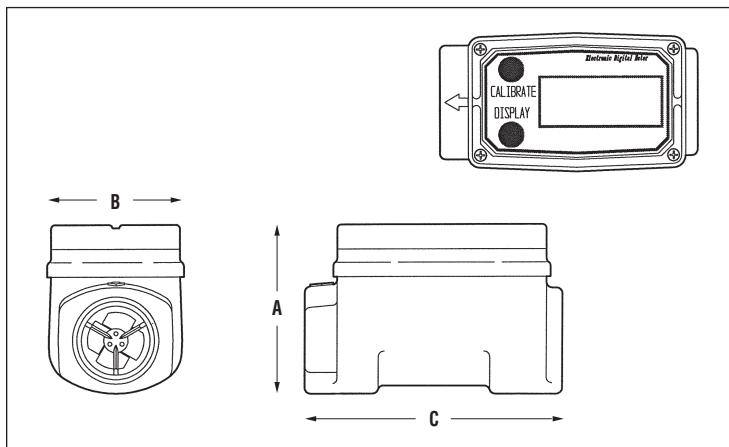
Temperature Range

-40° F to +250°F (-40° C to +121° C)

These temperatures apply to operations and storage. They are only for the turbine without computer electronics. Final operational temperature range is determined by computer electronics or accessory modules.

* Accuracy can vary up to ±5% depending on installation and fluid type. Field calibration is recommended for best accuracy.

SPECIFICATIONS continued



Dimensions

Models Size	A109GMA025NA1 1 inch Low Flow	A109GMA100NA1 1 inch	A109GMA200NA2 2 inch
A = Height†: Inches Centimeters	2.5 in. 6.3 cm	2.5 in. 6.3 cm	4.25 in. 11.4 cm
B = Width Inches Centimeters	2.0 in. 5.1 cm	2.0 in. 5.1 cm	3.0 in. 7.6 cm
C = Length Inches Centimeters	4.0 in. 10.1 cm	4.0 in. 10.1 cm	6.0 in. 15.2 cm

† Height includes 0.7 inch (1.8 cm) for the computer electronics.

Display Specifications

Input Pulse Rate:

Minimum Pulse In: DC
Minimum Coil Input: 10 Hz
Maximum Raw: 1,000 Hz

Temperatures:

Operational:	0° to +140° F (-18° to +60° C)
Storage:	-40° to +158° F (-40° to +70° C)

K-Factor:

Minimum: .01 pulses/unit
Maximum: 999,999 pulses/unit

If wider operating temperature ranges are desired, reference information on Remote Kits.

Field Calibration:

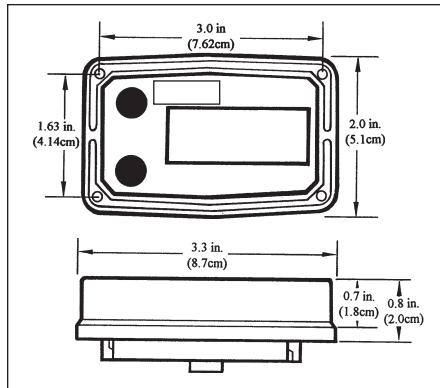
Minimum Time: 10 seconds

Power:

Internal Power Supply:	2 Lithium Batteries at 3 volts each
Battery Life:	4 years

Readout Totals:

Minimum Display: 0.01
Maximum Display: 999,999



PARTS & ACCESSORIES

Order Replacement Kit with the part number given here.

Part Number	Description
FTB899-ORING	O-Ring

Field Installable Options and Accessories

Model Number	Description
FTB790-RK	Remote Display Kit Module
FLSC790-P-ND	Pulse Output for Models without Displays (-ND suffix)(open collector output)

Except as noted, Options and Accessories are for Display Models only and only one Module may be installed per unit. All models are supplied with 10 ft. cable. Cable may be cut or extended as required. Customer supplied pull-up resistor required, 820 ohm (min).



WARRANTY/DISCLAIMER

OMEGA ENGINEERING, INC. warrants this unit to be free of defects in materials and workmanship for a period of **13 months** from date of purchase. OMEGA's Warranty adds an additional one (1) month grace period to the normal **one (1) year product warranty** to cover handling and shipping time. This ensures that OMEGA's customers receive maximum coverage on each product.

If the unit malfunctions, it must be returned to the factory for evaluation. OMEGA's Customer Service Department will issue an Authorized Return (AR) number immediately upon phone or written request. Upon examination by OMEGA, if the unit is found to be defective, it will be repaired or replaced at no charge. OMEGA's WARRANTY does not apply to defects resulting from any action of the purchaser, including but not limited to mishandling, improper interfacing, operation outside of design limits, improper repair, or unauthorized modification. This WARRANTY is VOID if the unit shows evidence of having been tampered with or shows evidence of having been damaged as a result of excessive corrosion; or current, heat, moisture or vibration; improper specification; misapplication; misuse or other operating conditions outside of OMEGA's control. Components which wear are not warranted, including but not limited to contact points, fuses, and triacs.

OMEGA is pleased to offer suggestions on the use of its various products. However, OMEGA neither assumes responsibility for any omissions or errors nor assumes liability for any damages that result from the use of its products in accordance with information provided by OMEGA, either verbal or written. OMEGA warrants only that the parts manufactured by it will be as specified and free of defects. OMEGA MAKES NO OTHER WARRANTIES OR REPRESENTATIONS OF ANY KIND WHATSOEVER, EXPRESS OR IMPLIED, EXCEPT THAT OF TITLE, AND ALL IMPLIED WARRANTIES INCLUDING ANY WARRANTY OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE HEREBY DISCLAIMED. **LIMITATION OF LIABILITY:** The remedies of purchaser set forth herein are exclusive, and the total liability of OMEGA with respect to this order, whether based on contract, warranty, negligence, indemnification, strict liability or otherwise, shall not exceed the purchase price of the component upon which liability is based. In no event shall OMEGA be liable for consequential, incidental or special damages.

CONDITIONS: Equipment sold by OMEGA is not intended to be used, nor shall it be used: (1) as a "Basic Component" under 10 CFR 21 (NRC), used in or with any nuclear installation or activity; or (2) in medical applications or used on humans. Should any Product(s) be used in or with any nuclear installation or activity, medical application, used on humans, or misused in any way, OMEGA assumes no responsibility as set forth in our basic WARRANTY/DISCLAIMER language, and, additionally, purchaser will indemnify OMEGA and hold OMEGA harmless from any liability or damage whatsoever arising out of the use of the Product(s) in such a manner.

RETURN REQUESTS/INQUIRIES

Direct all warranty and repair requests/inquiries to the OMEGA Customer Service Department. BEFORE RETURNING ANY PRODUCT(S) TO OMEGA, PURCHASER MUST OBTAIN AN AUTHORIZED RETURN (AR) NUMBER FROM OMEGA'S CUSTOMER SERVICE DEPARTMENT (IN ORDER TO AVOID PROCESSING DELAYS). The assigned AR number should then be marked on the outside of the return package and on any correspondence.

The purchaser is responsible for shipping charges, freight, insurance and proper packaging to prevent breakage in transit.

FOR **WARRANTY** RETURNS, please have the following information available BEFORE contacting OMEGA:

1. Purchase Order number under which the product was PURCHASED,
2. Model and serial number of the product under warranty, and
3. Repair instructions and/or specific problems relative to the product.

FOR **NON-WARRANTY** REPAIRS, consult OMEGA for current repair charges. Have the following information available BEFORE contacting OMEGA:

1. Purchase Order number to cover the COST of the repair,
2. Model and serial number of the product, and
3. Repair instructions and/or specific problems relative to the product.

OMEGA's policy is to make running changes, not model changes, whenever an improvement is possible. This affords our customers the latest in technology and engineering.

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- Load Cells & Pressure Gages
- Displacement Transducers
- Instrumentation & Accessories

FLOW/LEVEL

- Rotameters, Gas Mass Flowmeters & Flow Computers
- Air Velocity Indicators
- Turbine/Paddlewheel Systems
- Totalizers & Batch Controllers

pH/CONDUCTIVITY

- pH Electrodes, Testers & Accessories
- Benchtop/Laboratory Meters
- Controllers, Calibrators, Simulators & Pumps
- Industrial pH & Conductivity Equipment

DATA ACQUISITION

- Data Acquisition & Engineering Software
- Communications-Based Acquisition Systems
- Plug-in Cards for Apple, IBM & Compatibles
- Datalogging Systems
- Recorders, Printers & Plotters

HEATERS

- Heating Cable
- Cartridge & Strip Heaters
- Immersion & Band Heaters
- Flexible Heaters
- Laboratory Heaters

ENVIRONMENTAL MONITORING AND CONTROL

- Metering & Control Instrumentation
- Refractometers
- Pumps & Tubing
- Air, Soil & Water Monitors
- Industrial Water & Wastewater Treatment
- pH, Conductivity & Dissolved Oxygen Instruments